

**Claims**

1. Printing process for the transfer of printing substance (2) from an ink carrier (1) to an imprinting material (6), in which, with the help of an energy-emitting apparatus, which, during a process period, emits energy in the form of electromagnetic waves (3), the printing substance (2) undergoes a change in volume and/or position, **characterized in that**, with the help of absorption bodies (4), energy is transferred from the electromagnetic waves (3) into the printing substance (2).  
5
2. Printing process according to claim 1, characterized in that absorption bodies (4) are used which are smaller than the wavelength of the electromagnetic waves (3), preferably smaller than 1/10, particularly preferably smaller than 1/50 of the wavelength of the electromagnetic waves (3).  
10
3. Printing process according to claim 1 or 2, characterized in that the apparatus emits energy in the form of laser light (3).  
15
4. Printing process according to one of claims 1 to 3, characterized in that a printing substance (2) is used which contains absorption bodies (4).  
20
5. Printing process according to one of claims 1 to 4, characterized in that the absorption bodies (4) absorb essentially all the light wavelengths.  
25
6. Printing process according to one of claims 1 to 4, characterized in that the absorption bodies (4) absorb essentially only the radiation with a wavelength or in a wavelength range which corresponds to the wavelength or wavelength range of the electromagnetic waves 3 emitted by the energy-emitting apparatus.  
30
7. Printing process according to claim 6, characterized in that the absorption bodies (4) are also used as dye.

8. Printing process according to one of claims 6 or 7, characterized in that the absorption bodies (4) are accelerated in the direction of the imprinting material (6) by the electromagnetic waves (3) of the energy-emitting apparatus.

5

9. Printing process according to one of claims 1 to 5, characterized in that an ink carrier (1) is used, on whose surface provided to receive the printing substance (2) absorption bodies (4) are present which preferably form a solid layer.

10 10. Printing process according to one of claims 1 to 9, characterized in that the printing-point size is controlled by the quantity of energy released by the energy-emitting apparatus.

11. Printing process according to claim 10, characterized in that the quantity of energy released by the energy-emitting apparatus is controlled by the process period.

15 12. Printing process according to one of claims 3 to 11, characterized in that the printing-point size is controlled by the profile of the laser light.

20 13. Printing process according to one of claims 1 to 12, characterized in that differences in brightness of the image to be printed are achieved by variation of the printing-point size.

25 14. Printing process according to one of claims 1 to 13, characterized in that the process period is shorter than 1  $\mu$ s, preferably shorter than 250 ns, particularly preferably shorter than 100 ns and best of all shorter than 50 ns.

30 15. Printing process according to one of claims 1 to 14, characterized in that during the process period an energy density higher than 500 kW/cm<sup>2</sup>, preferably higher than 2 MW/cm<sup>2</sup>, particularly preferably higher than 10 MW/cm<sup>2</sup>, is generated at the absorption body (4).

16. Printing process according to one of claims 1 to 15, characterized in that the absorption bodies (4) are heated during the process period with an average heating rate greater than  $10^9$  K/s, preferably greater than  $10^{10}$  K/s, particularly preferably greater than  $10^{11}$  K/s.

5 17. Printing process according to one of claims 1 to 16, characterized in that the chosen thickness of the printing substance (2) on the ink carrier is less than 50  $\mu\text{m}$ , preferably less than 30  $\mu\text{m}$ , particularly preferably less than 20  $\mu\text{m}$ .

10 18. Printing process according to one of claims 1 to 17, characterized in that the printing substance (2) is selected so that the viscosity lies between 0.05 and 0.5 Pas.

15 19. Printing process according to one of claims 1 to 18, in which absorption bodies (4) and printing substance (2) are selected so that the absorption bodies (4) are wetted as well as possible by the printing substance (2).

20 20. Printing process according to one of claims 1 to 19, characterized in that, for the production of a printing point with a diameter greater than 100  $\mu\text{m}$ , an energy of not more than 10  $\mu\text{J}$ , preferably not more than 5  $\mu\text{J}$ , is transferred.

25 21. Printing process according to one of claims 1 to 20, characterized in that printing is line-by-line, areas to be printed within a line being formed by line segments of any choosable length and any choosable position.

22. Printing process according to claim 21, characterized in that the line-by-line printing takes place with a continuous wave laser, which travels line-by-line down the lines of print following a preset raster and which can be switched on and off or revealed or masked as desired along a line.

23. Printing process according to one of claims 1 to 22, characterized in that a printing point is transferred onto the imprinting material through the change in volume and/or position of the printing substance.
- 5 24. Printing process according to one of claims 1 to 22, characterized in that through the change in volume and/or position of the printing substance some of the printing substance is removed from the ink carrier and the remaining printing substance is at least partly transferred to the imprinting material.
- 10 25. Printing machine for printing on an imprinting material with an ink carrier (1) and an energy-emitting apparatus, which is arranged such that energy can be transferred in a targeted manner onto certain areas of the ink carrier (1), characterized in that absorption bodies (4) are provided for absorbing the energy.
- 15 26. Printing machine according to claim 24, characterized in that the energy-emitting apparatus is a laser.
27. Printing machine according to claim 25 or 26, characterized in that the absorption bodies (4) are of a size which is smaller than 1  $\mu\text{m}$ , preferably smaller than 200 nm and particularly preferably are of a size between 10 and 50 nm.
- 20 28. Printing machine according to claim 27, characterized in that the absorption bodies consist of carbon black particles and/or titanium nitride.
- 25 29. Printing machine according to one of claims 25 to 27, characterized in that the absorption bodies (4) are arranged in an absorption layer (9) arranged on the ink carrier (1).
- 30 30. Printing machine according to claim 29, characterized in that the ink carrier (1) is cylindrical and the absorption layer (9) is fixed on the ink carrier.

31. Printing machine according to claim 29, characterized in that the absorption layer (9) is arranged on the ink carrier (1) in the form of a flexible strip.
32. Printing machine according to one of claims 29 to 31, characterized in that the proportion of the absorption bodies (4) in the absorption layer (5) is greater than 40 wt.-%, preferably greater than 70 wt.-% and particularly preferably greater than 90 wt.-%
33. Printing machine according to one of claims 29 to 32, characterized in that the absorption layer (9) consists of pressed absorption bodies (4).
34. Printing machine according to one of claims 29 to 33, characterized in that the absorption bodies (4) are embedded in an organic or inorganic polymer matrix.
35. Printing machine according to one of claims 29 to 34, characterized in that the absorption bodies (4) are embedded in an elastomer matrix, preferably in rubber.
36. Printing machine according to one of claims 25 to 35, characterized in that the ink carrier (1) has a surface structure which consists of recesses and/or elevations.
37. Printing machine according to claim 36, characterized in that the recesses and/or elevations have a diameter smaller than 30  $\mu\text{m}$ , preferably smaller than 15  $\mu\text{m}$ .
38. Printing machine according to claim 36 or 37, characterized in that the recesses and/or elevations have a diameter greater than 2  $\mu\text{m}$ .
39. Printing machine according to one of claims 36 to 38, characterized in that the recesses and/or elevations have different diameters.
40. Printing machine according to one of claims 36 to 39, characterized in that the recesses and/or elevations are groove-shaped.

41. Printing machine according to one of claims 36 to 40, characterized in that the recesses and/or elevations are arranged on an absorption layer which contains the absorption bodies.

5

42. Printing machine according to one of claims 25 to 41, characterized in that light-focussing elements are applied to the ink carrier.

10 43. Printing machine according to claim 42, characterized in that the light-focussing elements have a diameter smaller than 30  $\mu\text{m}$ , preferably smaller than 10  $\mu\text{m}$ .

44. Printing machine according to claim 42 or 43, characterized in that the ink carrier is transparent and the light-focussing elements are integrated into the ink carrier.

15 45. Printing machine according to one of claims 42 to 44, characterized in that the light-focussing elements are formed by a flexible polymer film.

46. Printing substance, characterized in that absorption bodies (4) are included.

20 47. Printing substance according to claim 46, characterized in that the absorption bodies (4) are of a size which is smaller than 1  $\mu\text{m}$ , preferably smaller than 200 nm and particularly preferably between 10 and 50 nm.

25 48. Printing substance according to claim 46 or 47, characterized in that the printing substance consists of binder, dye or pigment, solvent, additives and the absorption bodies (4).

49. Printing substance according to one of claims 46 to 48, characterized in that the absorption bodies (4) form the dye.

30

50. Printing substance according to one of claims 46 to 49, characterized in that a blowing agent, preferably alcohol, ester, ketones or water, is included.

51. Printing substance according to claim 50, characterized in that the blowing agent is  
5 a solvent.

52. Printing substance according to claim 50 or 51, characterized in that the proportion of the blowing agent is > 10 wt.-% preferably > 12 wt.-%, particularly preferably > 15 wt.-%

10

53. Use of a printing substance according to one of claims 46 to 52 in a printing process according to one of claims 1 to 24 and/or with a printing machine according to one of claims 25 to 45.